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TABLE VIII

PERSONS HOLDING DEGREES CONFERRED BY THEOLOGICAL SCHOOLS

Year	Number Graduating	Those Living on June First				
		1920	1910	1900	1890	1880
*1915–19	10,175	10,007				
1910–14	9,440	9,004				
1905–09	8,147	7,485	8,009			
1900–04	8,179	7,159	7,799			
1895–99	8,338	6,900	7,658	8,198		
1890–94	7,030	5,423	6,159	6,706		
1885–89	5,113	3,619	4,242	4,704	5,032	
1880–84	3,737	2,317	2,883	3,272	3,565	
*1785–79	3,784	1,950	2,663	3,127	3,472	3,719
1870–74	3,465	1,384	2,151	2,673	3,036	3,306
1865–69	2,815	772	1,456	1,985	2,331	2,586
1860–64	2,289	357	915	1,421	1,765	2,005
1855–59	1,864	126	510	964	1,314	1,544
1850–54	1,518	25	237	607	943	1,171
1845–49	1,236		89	337	640	872
1840–44	1,006			158	401	623
1835–39	816			56	223	423
1830–34	663				105	264
1825–29	538				36	146
1820–24	438					68
1815–19	360					25
Total	80,951	56,528	44,771	34,208	22,863	16,752

* Figures for the number of graduates prior to 1880 and for the period 1915–19 are estimates.

tory, Greek, Latin, and Rhetoric. Compare these requirements with the following quotation from the 1910 report of the commissioner of education: "In the 114 legal institutions with the exception of the law departments of about one dozen universities admission is readily granted to graduates of high schools. About one-quarter of the law schools allow graduation after two years of attendance and two schools grant degrees after only one year of attendance."

One cannot but be impressed in studying these figures by the increasing importance of the college-trained man in the professions. More and more he is becoming the dominating figure among professional men. In 1880, 59 per cent of our physicians held a medical degree, while in 1910, 95 per cent of them had received this degree. Apparently our health is better attended to than either our property or spiritual welfare, yet these last two professions show the same increasing dominance of the college-trained man.

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THE BEST INDEX OF BUILD

Robustness is a rough index of health. Since the weight of men varies with their height, the mere weight is of little use as an index of robustness, and just how robustness may be best expressed quantitatively is a matter of doubt. The naive procedure is to divide the weight by the height, but this has the serious objection that while height is a linear dimension, weight is really a volumetric dimension. Were men approximately cylinders of different height, then the weight divided by the height would give an appropriate index of build; but obviously the hypothesis is not in accordance with the facts. It has sometimes been urged that since bodies of the same shape but of different size vary in volume as the cube of any diameter, that weight should be divided by the cube of height in order to secure index of build; but the hypothesis that men of different stature are of the same form is also not justified; for tall men have a prevailingly slender build and short men are on the average stockier. Nevertheless, the method of securing a measure of build by dividing weight by the cube of the height has been extensively used and is urged by Professor C. R. Bardeen in a recent publication (Number 272) of the Carnegie Institution of Washington.

A test of the best method of measuring build may be made as follows: An extensive table of army measurements shows that the commonest stature is 67 inches, that the commonest combined units of stature and weight are the group 67 inches tall and 137 pounds in weight. The quotient for this modal class of

$$\frac{137 \text{ pounds}}{67 \text{ inches}}$$

is, in the case of the first power of 67, 2.045; for one hundred times the quotient obtained by using the second power as a divisor, 3.052, and for 10,000 times the quotient obtained by using the third power of 67 as a divisor, 4.555. By taking now a series of combinations of weight and height in each of which there is found at least 1 per cent of men as measured in the army draft, we secure a series of fractions in which the numerator is the weight in pounds and the denominator the height in inches. The selected measures are:

$$\frac{117}{63}, \frac{127}{63}, \frac{117}{65}, \frac{127}{65}, \frac{137}{65}, \frac{117}{67}, \frac{127}{67}, \frac{147}{67}, \frac{157}{67}, \frac{127}{69}, \frac{137}{69}, \frac{147}{69}, \frac{157}{69}, \frac{147}{71}, \frac{157}{71}, \frac{167}{71}.$$

These relations were worked out by using the weight in pounds as the dividend and by using as a divisor in turn the first power, the second power, and the third power of the height in inches. From each of the quotients in which the first power of the height was used as a divisor there was obtained the deviation from 2.047; the deviation from 3.052 was obtained from each of the quotients when the second power was used as a divisor; and the deviation from 4.555 when the third power of the height was used as a divisor. The sum of the deviations disregarding signs was, when the first power was used as a divisor, 2.587. Divided by the reference standard of 2.045, this gives 1.265, which is the *relative* variability of the sixteen group combinations as obtained by using the first power of the height as a divisor. By using the second power of the height as a divisor, the corresponding figure is 1.146; by using the third power as a divisor, it is 1.237. Hence, the outlying groups give the smallest deviation from the condition found in the central group when the second power of the height is used as a divisor.

In still another way can we show that by using the second power of height as a divisor better results are obtained than by using the first or the third power. As is well known, shorter men are on the average more robust than tall men. By calculating the ratios for shorter and taller men of the same average weight with the use of the first, second, and third powers of height respectively, we secure the results indicated in Table I.

TABLE I

SHOWING (A) THE WEIGHT AND HEIGHT FOR WHICH THE WEIGHT-HEIGHT INDEX IS CALCULATED; (B) THE CORRESPONDING INDEX WHEN THE FIRST POWER OF HEIGHT IS USED; (C) THE CORRESPONDING INDEX WHEN THE SECOND POWER OF HEIGHT IS USED; (D) THE CORRESPONDING INDEX WHEN THE THIRD POWER OF HEIGHT IS USED

(A)			(B)			(C)			(D)		
$\frac{117}{61}$	$\frac{117}{66}$	$\frac{117}{70}$	1.92	1.77	1.67	3.14	2.69	2.39	5.16	4.07	3.41
$\frac{127}{62}$	$\frac{127}{67}$	$\frac{127}{71}$	2.05	1.90	1.79	3.30	2.30	2.52	5.33	4.22	3.55
$\frac{137}{63}$	$\frac{137}{68}$	$\frac{137}{72}$	2.18	2.01	1.90	3.45	2.96	2.64	5.48	4.36	3.67
$\frac{147}{64}$	$\frac{147}{69}$	$\frac{147}{73}$	2.30	2.13	2.01	3.59	3.09	2.76	5.60	4.47	3.78
$\frac{157}{64}$	$\frac{157}{69}$	$\frac{157}{73}$	2.45	2.28	2.15	3.83	3.3	2.95	5.99	4.79	4.04
$\frac{167}{65}$	$\frac{167}{70}$	$\frac{167}{74}$	2.57	2.39	2.26	3.95	3.41	3.05	6.08	4.87	4.12

From this table it appears that when the first power of height is used in the ratio, the increase in robustness of abmodally short men over abmodally tall men is about 10 per cent; with the second power it is about 30 per cent; with the third power it is about 50 per cent. It is quite clear that the shorter men are not 50 per cent more robust on the average than the tall men, though opinion may be divided as to whether a 30 per cent or a 10 per cent increase more nearly agrees with the general impression obtained by observing a number of men 4 inches above the mean as compared with the number of men measuring 5 inches below the mean stature.

In still another respect does the use of the square of the height in determining the build show its superiority as a measure over the first and second power of height. Thus if we start with the data given in Bardeen's Table E, which in turn is based on one of Quetelet's (1870), we may compare the coefficients of build for different years of development from one to thirty, and we may compare the coefficients of build as obtained by calculating the ratio of weight to the first power of height, to the second power of height, and to the third power of height, respectively, for each year. We then select some median age at a point of departure and for this purpose we select twelve years. We then find the deviations of the respective ratios from the twelve-year ratio and divide the average deviation by the first year ratio in order to secure a coefficient referred to the appropriate standard. In consequence of the suggestion made by Quetelet, it is worth while to calculate also the ratio of weight to the $2\frac{1}{2}$ power of height and to find the corresponding coefficient.

The suggested calculations have been made and are given in Table II. The first column gives the age in years of the group measured, the second column

TABLE II

DEVIATIONS OF WEIGHT-HEIGHT INDEXES FROM 12 YEAR RATIO

	$\frac{\text{Weight}}{\text{Height}}$	$\frac{\text{Weight}}{\text{Height}\,(^{2})}$	$\frac{\text{Weight}}{\text{Height}\,(^{3})}$	$\frac{\text{Weight}}{\text{Height}\,(^{2\frac{1}{2}})}$
12 year ratio	210.909	1.5339	.1116	.13081
Birth	148.909	.2939	.1364	.04455
1 yr.	82.024	.3134	.1530	.09030
2 yr.	71.845	.2242	.1107	.06686
3 yr.	66.233	.1405	.0822	.04934
4 yr.	59.885	.0952	.0641	.03840
5 yr.	49.815	.0983	.0538	.03348
6 yr.	40.737	.0930	.0439	.02826
7 yr.	32.567	.0724	.0348	.02362
8 yr.	25.023	.0659	.0261	.01756
9 yr.	17.970	.0502	.0185	.01272
10 yr.	12.952	.0212	.0106	.00702
11 yr.	6.137	.0040	.0045	.00279
12 yr.				
13 yr.	21.698	.1007	.0033	.00622
14 yr.	31.643	.1853	.0054	.01110
15 yr.	61.398	.2659	.0074	.01551
16 yr.	81.240	.3461	.0094	.02000
17 yr.	100.885	.4222	.0111	.02412
18 yr.	119.766	.4948	.0129	.02809
19 yr.	137.127	.5691	.0155	.03266
20 yr.	145.378	.5996	.0162	.03428
25 yr.	182.670	.8061	.0175	.04961
30 yr.	181.143	.7914	.0263	.04827
Total deviation	1677.035	6.0534	.8636	.68476
Average deviation	76.229	.2752	.03925	.031125
Average deviation divided by 12 year ratio	.3614	.1794	.3517	.2379

gives the ratio of weight to the first power of height, and the succeeding columns the ratios of weight to the second, third, and 2½ powers of height respectively. The ratio for twelve-year old persons is given in the first line, and in the subsequent lines are given the deviations from the twelve-year old ratio. At the bottom is given the average deviation for all the ages from the twelve-year old ratio, and in the line below that, the relative deviation as obtained by dividing the average deviation by the twelve-year old ratio. One sees that in the relative average deviations the worst result is given by the use of the first power of the height, the next poorest by using the third power, the next by using the 2½ power. The smallest average deviation from the assumed standard is given by dividing weight by the second power of the height.

From these different tests, therefore, we draw the conclusion that the best index of build is the weight divided by the square of the height. The theoretical justification for this lies in the fact that since men do not vary in volume by the first power of height like cylinders of the same diameter, nor like spheres by the cubes of height, but in a manner intermediate between the two, so that we may expect to find the appropriate divisor for the index of build not the first power or the third power, but some intermediate power, and apparently the second power of height shows its superiority to either of the others and even to the 2½ power. It is on this account that the best single index of build is secured by dividing weight by the square of stature.

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